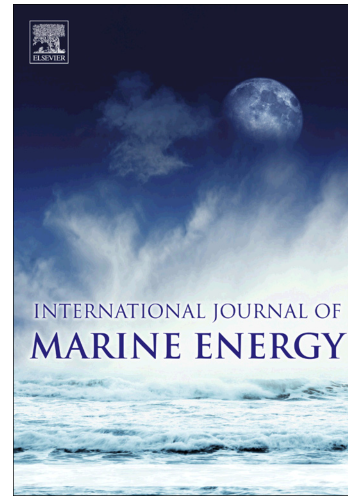

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Abstract—**The compromise between Wave Energy Converter (WEC) performance, cost and survival is both a delicate and critical one. A successful WEC design must effectively address the exploitable wave energy, but survive the climate extremes. Bombora Wave Power has focussed on designing a WEC that performs well in less extreme nearshore climates and is able to decouple its working surfaces from extreme waves. Numerical modelling of the performance of their submerged, pneumatic, flexible membrane WEC, the *mWave*, is presented. The *mWave* power matrix is found to provide good performance over a broad range of wave periods, with a broad peak in performance at wave periods of 9*s* for the assumed design parameters. This broad peak corresponds favourably to the sea-state probabilities in a typical near-shore shallow water wave climate, yielding a predicted mean annual electrical power production of 240kW in such conditions. Small scale physical modelling of the relationship between the initial level of inflation of the *mWave* cell membranes and the system's power capture has confirmed the possibility of an *mWave* survival strategy that can potentially allow safe, de-rated performance in extreme conditions. Future work is planned to further improve predicted *mWave* performance by refinement of power take-off damping and to physically validate these performance modelling results at full scale.**

***Keywords*— Wave energy converter, *mWave*, numerical modelling, power matrix, membrane, submerged.**

1 Introduction

Modern efforts to develop a commercially viable wave energy converter (WEC) extend back many decades. The ability of various WEC concepts to convert energy has been demonstrated, but still no successful commercial product exists. In a recent keynote address [1] at the 2016 Australian Ocean Renewable Energy Symposium, it was observed that abandonment of WEC prototypes has most commonly been due to reliability failures and not due to poor power performance. The challenge for developers has become designing a WEC that is less vulnerable to these issues while maintaining good performance.

Reliability is such a critical issue in WEC development due to the extremes of the operating environment. At offshore locations, a WEC may experience extreme wave heights more than six times greater than in the prevailing operating conditions at the same location [2].

Engineering a WEC to survive the very high loads in these extreme conditions may be technically feasible, but increases cost. The fundamental performance criteria for a WEC is not its energy production alone, but instead the Levelised Cost of Energy (LCOE). Therefore, a viable WEC solution must either compensate for the high cost of over-engineering the WEC to survive extreme conditions by increasing power production, or somehow reduce the effect of extreme conditions on design duty.

1.1 Near-shore and offshore wave climates

It is true, for most WECs, that greater annual energy production can be obtained in deep water (assuming the same degree of WEC submergence), where the annual total incident wave energy is greater. However, the additional energy that is exploitable in deep water is not so great as it may first appear, and can come at a high cost.